ANTHRAX REMEDIATION AND RESPONSE

RELATED APPLICATION

This non-provisional application claims priority from provisional application no. 60/484,924 filed on July 3, 2003, and is a continuation-in-part of serial no.10/422,708, filed on April 24, 2003.

FIELD OF THE INVENTION

This invention relates generally to methods for responding to bioterrorism attacks and, more specifically, relates to a method or methods for responding to a bioterrorism attack that addresses the de-contamination of goods, vehicles, facilities, and personal protection equipment that are at least potentially contaminated as a result of such an attack and/or its remediation. Preferably, these individual methods are integrated into a coordinated response, or battle plan, following a bioterrorism attack.

BACKGROUND OF THE INVENTION

In 2001, the world witnessed the danger posed by a bioterrorism attack. Beginning in the fall of 2001, a series of letters containing spores from the bacterium Bacillus anthracis were sent through the U.S. Postal system. Handlers and recipients of certain of these letters contracted anthrax, with more than 20 becoming ill and five dying.

This incident posed a number of challenges to those tasked with the responsibility for remediation. These included: (a) devising a method for treating mail that had either been exposed to anthrax spores, or where there was at least a concern of potential exposure; (b) devising and demonstrating a method for decontaminating vehicles used to transport such mail for decontamination or otherwise; (c) decontaminating a facility where there has been a bioterrorism attack or at least the possibility of one; and (d) devising a decontamination method for persons (including specifically their protective gear) who are required to enter a facility where there has been a possible bioterrorism attack.

These methods address the need for effective responses to bioterrorism. They have application not only to mail items, vehicles and facilities, but to other targets of bioterrorism. Further, they have application to anthrax-type bioterrorism attacks, as well as attacks utilizing other biological agents.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a remediation method in response to a bioterrorism attack, and in particular to treat goods, such as mail items, that have at least potentially been exposed to such an attack.

It is a yet further object of the present invention to provide a method in response to a bioterrorism attack, and in particular to treat vehicles that have at least potentially been

exposed to such an attack.

It is a still further object of the present invention to provide a method in response to a bioterrorism attack, and in particular to decontaminate a facility that has at least potentially been exposed to such an attack.

It is a yet further object of the present invention to provide a method in response to a bioterrorism attack, and in particular to decontaminate persons (including specifically their protective gear) who are required to enter a facility that has at least potentially been exposed to such an attack.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a flow chart illustrating the treatment of mail items suspected of exposure to a biological agent.

Figure 2 is a flow chart illustrating the remediation of a vehicle interior possibly exposed to a biological agent.

Figure 3 is a block diagram illustrating the relative position of the exclusion zone, the contamination reduction zone and the support zone relative to one another.

Figure 4 is a flow chart illustrating the steps followed by a person seeking to enter an exclusion zone, exit therefrom, and decontaminate his or her personal protective equipment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A bioterrorism attack poses a number of challenges for a proper and comprehensive response. While at least certain of the methods disclosed herein have been utilized in connection with a

response to an anthrax-type of attack, it should be noted that they could be utilized with other biological agents. In this regard, the following is a classification of biological agents which may be used as bioweapons, and for which remediation as herein described is believed and now proven effective:

1. Bacteria - bacteria are small free-living organisms, most of which may be grown on solid or liquid culture media. They have a structure generally consisting of nuclear material disposed within cytoplasm, and are bounded by a cell membrane. Bacteria reproduce by simple division. The diseases that bacteria produce often respond to specific therapy with antibiotics.

Bacillus anthracis is an example of a bacteria type of biological agent. It was the first bacterium shown to be the cause of a disease. It most commonly occurs in wild and domestic lower vertebrates, such as cattle, sheep, goats, camels, antelopes and other herbivores. It can also occur in humans, typically when they are exposed to infected animals or to tissue from infected animals. The disease is acquired by skin contact with the bacteria or by inhaling the bacteria spores. The spores are capable of attaching to the clothing of a person who has entered a contaminated area.

Anthrax infection can occur in three forms: cutaneous, inhalation, and gastrointestinal. Cutaneous anthrax occurs after the bacteria contact skin cuts or abrasions. Usually within two weeks, an itchy skin lesion develops that is similar to an insect

bite. This lesion may later blister and then break down, resulting in a black, frequently painless, ulcer. In 20% of cases where the individual is untreated, the infection may spread through the bloodstream and become fatal. Otherwise, with treated individuals, death from cutaneous anthrax is extremely rare.

Inhalation anthrax develops when anthrax spores enter the lungs. Development of the actual disease occurs after the spores germinate, a process that may take up to 60 days. Once the spores germinate, several toxic substances are released. This results in hemorrhage, swelling, and tissue death. In the first stage of inhalation anthrax, the individual can experience fever, headache, cough, shortness of breath, and chest pain. The second stage develops suddenly, and is characterized by shortness of breath, fever, and shock. Most of these cases are fatal.

Gastrointestinal anthrax occurs with ingestion of contaminated meat. Disease in these cases usually develops within one week and can affect the upper portion of the gastrointestinal tract or the intestines and colon. The infection can enter the bloodstream and result in death.

2. Viruses - Viruses are organisms that require living cells in which to replicate, and are therefore dependent upon the cells of the host that they infect. Their stability in the environment is very variable. They produce diseases which generally do not respond to antibiotics, but which may be responsive to anti-viral compounds. Supportive care (e.g.,

fluids, anti-inflammatories and rest) is often the only treatment for viral infections.

3. Rickettsiae - these are microorganisms that have characteristics common to both bacteria and viruses. Like bacteria, they possess metabolic enzymes and cell membranes, utilize oxygen and are susceptible to broad-spectrum antibiotics. They resemble viruses, on the other hand, in that they grow only within living cells.

4. Chlamydia - these are obligatory intracellular parasites that are incapable of generating their own energy source. Like bacteria, they are susceptible to broad-spectrum antibiotics. Like viruses, they require living cells for multiplication.

5. Fungi - these are primitive plants that utilize photosynthesis, are capable of anaerobic growth, and that draw nutrition from decaying vegetable matter. Most fungi form spores. Free-living forms are found in the soil. Fungal diseases may respond to various anti-microbial drugs.

6. Toxins - these are poisons that are produced by organisms. Toxins do not grow or reproduce. They are more easily controlled than live organisms. The potency of most toxins are such that very small doses will cause illness and/or death.

Evidence of a biological attack utilizing a biological agent can come in a number of ways. It is possible that the actual bioterror delivery system (e.g., the release of powdered material from processed mail or packages) may be observed. It can also

come from the observance of any of the following:

1. Unusual number of casualties - A large number of casualties within a 48 to 72 hour period suggests that there may have been an attack with a microorganism. If the casualties occur within minutes to an hour of each other, a toxin is a more likely suspect. A large number of clinical cases relative to the number of exposed individuals, or other epidemiological evidence of a massive single source disease outbreak may all be indicative of a bioterror attack.

2. Unusual distribution of casualties - A high number of persons afflicted with respiratory illness, or a casualty distribution that is related to wind direction, might indicate that an aerosol attack has occurred. This could be corroborated by evidence of lower casualty rates among those working indoors, and in particular in areas with filtered air or closed ventilation systems.

3. Unusual distribution - A large number of rapidly fatal cases, with few recognizable signs and symptoms, may indicate exposure to multiple lethal doses of a biological agent from a single source.

4. Unusual disease pattern - The disease pattern associated with an attack utilizing a biological agent is likely to differ from those of a naturally occurring epidemic. For example, except for food borne outbreaks, disease incidence in naturally occurring epidemics usually increases over a period of weeks or months. However, in a bioterrorism attack, the increase in

disease incidence may be only hours or days. Furthermore, instead of the usual peaks and troughs evidenced in most natural outbreaks, a steady and increasing stream of patients will be seen in a bioterror attack, similar to a food poisoning outbreak.

5. Unusual disease outbreak - the recurrence of a vector-borne disease without the vector (e.g., a mosquito or a tick) or the occurrence of a disease that is highly unusual for the geographic area could indicate that a bioterrorism attack has occurred.

6. Unusual disease symptoms - An unusually high prevalence of respiratory disease (e.g., pneumonia) from a disease that more often occurs naturally as a skin disease (e.g., inhalation in a natural outbreak) can be indicative of a bioterrorism attack.

7. Illness in animals and humans - an increased number of sick or dead animals, often of different species (e.g., rodents and dogs) at the same time as an increased number of human illness can be indicative of a bioterrorism attack.

Where a biological attack has occurred at a site such as a mail facility, those tasked with the remediation effort typically need to address remediation for exposed goods (e.g., mail items), for vehicles utilized in the response effort, for facilities where an attack has (or may have) occurred, and for persons (including their personal gear) who are involved in the remediation effort.

For goods of relatively small size, such as mail items, exposure to accelerated electron beam irradiation with sufficient

intensity and for a sufficient period of time can kill anthrax spores and thus decontaminate the goods. (Such treatment is widely used for sterilizing medical instruments, cosmetics, and pharmaceuticals -- in a non-bioterrorism context.) Testing has shown that such treatment does not produce or store any radiation in the treated goods. Moreover, it appears to produce no adverse health effects.

Turning particularly to a discussion of mail items suspected of contamination, it is preferred to arrange the mail items in a manner that will both ease their transportation (where this is necessary) and, more importantly, will optimize the efficiency of the irradiation treatment. First, it is desired to segregate mail items both by size and based on the contents thereof. Letter-size mail items, i.e., those having a height of approximately four inches or less, a length of no more than approximately 11 and 1/2 inches, and a thickness of no more than approximately 1/4 inch, may be optimally processed as hereinafter described. However, of these mail items, it will be desired to separate out letter-size mail items containing plastics, credit-cards, compact disks and the like for alternative processing, because the method described herein has been shown to be harmful to such items at certain dosage levels.

The mail items should be positioned in a letter tray having a height of four inches. The mail items should be placed horizontally (i.e., flat) within the tray, and can be stacked to the height of the tray walls. However, care should be taken so

that mail items are not positioned above the height of the walls.

The next step in the method is to place the filled tray into a letter tray sleeve. The letter tray sleeve is preferably closed by taping it along its length. The purpose of the letter tray sleeve is to maintain the letters in position within the tray.

The sleeve, with the filled tray therein, may next be inserted into a polyvinyl bag having a thickness of between about 3 and about 6 millimeters. (Generally, the use of a bag will be desired at higher dosage levels.) If used, the bag should be tied, preferably by goosenecking the opening and sealing it with duct tape. This sealed bag should then be inserted gooseneck-end first into a second polyvinyl bag, also having a thickness of between about 3 and about 6 millimeters. The second bag is sealed in like manner to the first -- i.e., by goosenecking the end and sealing it with duct tape.

It is next preferred to insert the double-bagged letter tray into a cardboard box of sufficient dimension to receive the bagged tray, for purposes of securing it for travel. For a standard letter tray, the desired box dimensions are as follows: (a) interior dimensions: 12 inches wide, 26 inches long, and 6.75 inches deep; (b) exterior dimensions: 12.25 inches wide, 26.5 inches long, and 7 inches deep. Of course, these dimensions may be varied, as desired. The box must then be sealed, preferably by taping it shut with packing-type tape, preferably having a width of about 2 to 3 inches. (Duct tape is not preferred for box-sealing purposes.) At a minimum, the packing tape should be

placed entirely around the width of the box.

Where the irradiation equipment is located remote from the facility where the mail has been packaged, the sealed boxes are loaded onto vehicles for transport to the treatment location.

At the treatment location, the sealed boxes are exposed to accelerated electron beam irradiation for a time period that is between approximately 30 minutes and approximately 1 hour. This amount of time has been shown to be optimal for decontamination purposes.

The general steps involved in the remediation of mail items suspected of possible exposure to a biological attack are depicted in the flow chart of Figure 1. It should be recognized that some departure from the specific steps described herein, which reflect a preferred embodiment, may be possible without departing from the spirit or scope of the present invention. Thus, it may be possible to substitute one thicker bag for the two described herein, to use more than two bags, to eliminate the tray sleeve or to provide more than one tray sleeve, and so on.

Where a vehicle has been used to transport mail items (or other goods) that are at least suspected of possible contamination as a result of a bioterrorism attack, it will be necessary to decontaminate the vehicle interior. For this process, it is first desired to create a suitable decontamination area. The features of such an area should include an underlying, impermeable layer that is strong enough to withstand the traction of tires. An additional desired feature is a barrier, such as a berm, to

prevent the run-off of liquids utilized in the decontamination process and to allow their collection at the end of the process. (It should be apparent that run-off prevention could be accomplished in other ways, for example by providing an area with a sloped floor leading to one or more drain openings, or otherwise.) Commercially available household bleach solution containing 5.25% hypochlorite, when diluted 10:1 is effective in routine decontamination of surfaces and instruments after working with B. anthracis.

Once the vehicle is positioned within a suitable decontamination area, its interior should be sprayed using the decontamination solution. The vehicle should then be permitted to stand exposed to the decontamination solution for approximately one hour, to allow sufficient contact time for the residual detergent to act. Once the spraying step is completed, the vehicle interior should be wiped down by hand, using clean cloths. Next, the vehicle interiors should be thoroughly rinsed with clean tap water, and then allowed to air dry. The general steps associated with vehicle decontamination are illustrated in the flow chart of Figure 2.

In order to undertake appropriate decontamination efforts with respect to a facility where a bioterrorism may have occurred, it is preferred to divide the suspected contamination site and its surrounding areas into at least three zones, as follows: (a) exclusion zone - this is the area that includes the source of the incident and which is therefore contaminated or is

at least suspected of having been contaminated; (b) contamination reduction zone - this is the area adjacent to the exclusion zone and is utilized for the decontamination and rinsing of personal protective equipment (PPE); and (c) support zone - these are located at the entry points to the contamination reduction zone. The position of these three zones relative to one another -- with the contamination reduction zone interposed between the support zone and the exclusion zone -- is illustrated in the block diagram of Figure 3.

The exclusion zone is the area where an attack is suspected to have occurred and where decontamination efforts are to be undertaken. Its boundaries are preferably determined from an initial post-attack assessment and is further based on an identification of hazards. Entry to the exclusion zone occurs only through the contamination reduction zone, and should be permitted only to persons wearing appropriate PPE's. It is preferred to clearly mark the exclusion zone with appropriate signage, so as to avoid accidental entry into the exclusion zone without proper equipment.

The contamination reduction zone is, as noted above, adjacent to the exclusion zone, and is a transition zone between the exclusion zone and the support zone. A person wearing a PPE (which has been donned in the support zone, discussed below) will pass through the contamination reduction zone and enter the exclusion zone. Such entrance preferably follows an inspection, which can occur in the support zone or in the contamination

reduction zone, to ensure that the PPE is being worn correctly. The contamination reduction zone will also have a de-contamination facility to be utilized by persons exiting the exclusion zone, and is configured to permit the decontamination of PPE's. All PPE's should be removed before a worker exits the contamination reduction zone for the support zone. This method -- donning of PEE in the support zone, entrance to the exclusion zone, exiting of the exclusion zone and passage into the contamination reduction zone, and decontamination of the PPE in the contamination reduction zone -- is shown in the flow chart of Figure 4.

The decontamination facility within the contamination reduction zone preferably consists of an enclosed tent system, having multiple (preferably four) stages. Within the tent system, and as more fully described below, decontamination, rinsing, and doffing of PPE's will occur.

The support zone is a clean zone, and is preferably a temporary structure, such as a trailer, that is not a fixed part of a facility containing a contamination site. In this manner, the support zone can be pre-configured in advance of a bioterrorism attack, and can be relatively quickly transported to the site and deployed for use. The support zone preferably contains, in addition to dressing facilities, equipment, the command post, and back-up personnel.

For persons needing to enter the contamination reduction zone and thereafter the exclusion zone, the support zone is used

for donning PPE's. For those exiting the contamination reduction zone, the support zone is utilized for heat stress monitoring and showering. The support zone may also be utilized for storing respirators and for the charging of respirator power packs.

Persons exiting the exclusion zone and entering the contamination reduction zone must subject their PPE's to a decontamination process. The purpose of this process is to prevent exposure to the persons wearing the PPE's, and to prevent the spread of contamination to clean areas of the site.

With respect to the PPE, it is preferred that two layers of protective clothing be worn. For example, it may be desired to utilize an outer suit that is a polycoated Tyvek type, and an inner suit that is a standard Tyvek type. Or, preferably, it may be desired to provide a standard Tyvek type suit for the outer layer, with scrubs underneath. Where heat stress is not a concern, an outer Saranex Tyvek type suit may be worn, over a polycoated Tyvek type suit.

It should be noted that in addition to the PPE, a worker entering an exclusion zone will generally be wearing at least the following: gloves, booties, safety goggles, and a respirator. Preferably, the respirator is a powered air purifying respirator, equipped with a suitable cartridge, such as an organic vapor/acid gas cartridge. (Cartridges should be discarded after each exit from the contamination reduction zone, and at least randomly sampled for evidence of contamination.) Preferably, the gloves are nitrile, and at least two pairs are worn - an inner pair and

an outer pair, with two inner pairs and an outer pair being preferred. For certain activities, an outer glove comprised of leather or the like may be desired. Also, for certain activities, work boots, such as those having steel toes, may be desired. Tape will be used to seal the sleeve and pant leg openings. In some instances, the worker will also wear a hood, which may be taped to the safety goggles.

As noted briefly above, it is preferred to divide the contamination reduction zone into four stages/areas, with different decontamination activities to occur in each area. Each stage/area should be defined by a separate tent, within the contamination reduction zone, and a person passes from area to area by exiting one tent and passing into the next. Some variation in the number of areas, and in the particular activities to occur in each, is possible, and may indeed be preferred depending on the circumstances.

In one embodiment, de-contamination proceeds as follows:

Area 1

The PPE is rinsed with a soap solution, with the rinse emptying into a bleach type solution. Rinsing should be conducted twice -- first the front of the suit, then the back, then the front again, and then the back again. If the worker was wearing a hood, this is rinsed as well. If not, the worker should lightly spray his or her head with the soap solution. The PPE should next be rinsed with water.

The tape is removed from the sleeve and pant leg openings.

The worker also removes the PPE and the outer and the first pair of inner gloves. The PPE should be placed in a container and sprayed with a bleach solution, with the solution left thereon for approximately one hour contact time.

Area 2

In the second area, the worker will remove his or her inner scrubs by cutting and/or tearing them away. These should not be pulled over the head. The booties are also removed. The discarded scrubs should be placed in a container and sprayed with a bleach solution, with the solution left thereon for approximately one hour contact time. The discarded booties may be placed in a container with the scrubs, or may be placed in a separate container and sprayed with a bleach solution, with the solution left thereon for approximately one hour contact time.

Area 3

In the next area, the worker removes his or her respirator (or other respiratory protection), as well as the second pair of inner gloves. The inner gloves are placed in a container and sprayed with a bleach solution, with the solution left thereon for approximately one hour contact time.

The respirator is placed into a bleach solution for approximately one hour. Its parts should be wiped down with the bleach solution, with the solution left thereon for an approximately one hour contact time. Thereafter, the respiratory should be rinsed with water and allowed to air dry.

Area 4

The next area is the showers area. All workers should shower before leaving the contamination reduction zone. Showering should be with soap and water.

In another embodiment, de-contamination proceeds as follows:

Area 1

The PPE is rinsed with a soap solution, with the rinse emptying into a bleach type solution. Rinsing should be conducted twice -- first the front of the suit, then the back, then the front again, and then the back again. If the worker was wearing a hood, this is rinsed as well. If not, the worker should lightly spray his or her head with the soap solution.

Area 2

In this area, the PPE is rinsed with water. The tape is removed from the sleeve and pant leg openings. The worker also removes the PPE and the outer and the first pair of inner gloves. The PPE should be placed in a container and sprayed with a bleach solution, with the solution left thereon for approximately one hour contact time.

Area 3

In the third area, the worker will remove his or her inner scrubs by cutting and/or tearing them away. These should not be pulled over the head. The booties are also removed. The discarded scrubs should be placed in a container and sprayed with a bleach solution, with the solution left thereon for approximately one hour contact time. The discarded booties may be placed in a container with the scrubs, or may be placed in a

separate container and sprayed with a bleach solution, with the solution left thereon for approximately one hour contact time.

The worker removes his or her respirator (or other respiratory protection), as well as the second pair of inner gloves. The inner gloves are placed in a container and sprayed with a bleach solution, with the solution left thereon for approximately one hour contact time.

The respirator is placed into a bleach solution for 15 minutes. Its parts should be wiped down with the bleach solution, with the solution left thereon for an approximately forty-five minute contact time. Thereafter, the respiratory should be rinsed with water.

Area 4

The next area is the showers area. All workers should shower before leaving the contamination reduction zone. Showering should be with soap and water.

It is noted that adverse weather conditions can impair the decontamination process. For example, severe winds can damage structures positioned around a building to aid in the decontamination effort. This includes materials used to seal a building to be decontaminated, structures related to the generation and delivery of a decontaminant, and the tent/trailer structures described herein. In addition, severe winds can cause an object to become airborne, creating what is known as a "missile hazard," creating a danger to workers and to structures on the site.

Accordingly, it will be preferred to monitor weather conditions, so that adequate warning can be provided of the onset of adverse conditions, such as hurricane-force winds, tornados, lightning, heavy rain, snow, ice, flooding, and severe storms. Preferably, wind speed, wind direction, ambient outside temperature, ambient relative humidity, and barometric pressure are monitored.

Monitoring should be conducted by a duly designated person, such as a site health and safety officer ("SHSO"). The SHSO should report the information received as a result of such monitoring to an appropriate person (such as an incident commander) so that appropriate action may be taken. That person may be, for example, a site superintendent, site manager, and/or site health and safety director.

It is preferred to utilize a warning system, based on, at least in part, the likely incidence of destructive winds. Destructive winds are considered to be winds that are determined to have the potential to cause property damage or personal injury. Generally, these are winds that reach or exceed the force of a tropical storm; i.e., having a speed of greater than 34 knots.) It is further preferred to create multiple conditions of readiness based on the possible arrival time of such winds. Preferably, five conditions of readiness are characterized:

Condition V - destructive winds are possible at the site within 96 hours. This condition continues until the storm or condition that may produce destructive winds is downgraded or changes track so as to no longer pose a threat to the site, or until Condition IV begins.

Condition IV - destructive winds are possible at the site within 72 hours. This condition continues until the storm or condition that may produce destructive winds is downgraded or changes track so as to no longer pose a threat to the site, or

until Condition III begins.

Condition III - destructive winds are possible at the site within 48 hours. This condition continues until the storm or condition that may produce destructive winds is downgraded or changes track so as to no longer pose a threat to the site, or until Condition II begins.

Condition II - destructive winds are possible at the site within 24 hours. This condition continues until the storm or condition that may produce destructive winds is downgraded or changes track so as to no longer pose a threat to the site, or until Condition I begins.

Condition I - destructive winds are possible at the site within 12 hours.

It should be noted that the accuracy of predicting where, for example, a hurricane landfall will occur is very low, more than 24 hours in advance of a storm. 72 hours before landfall, the maximum probability of hurricane landfall location is 10%; 48 hours before landfall, the maximum probability is 13-18 percent; 36 hours before landfall, the maximum probability is 20-25 percent; 24 hours before landfall, the maximum probability is 35-45 percent; and 12 hours before landfall, the maximum probability is 60-70 percent. As a result, it may be desired to provide fewer than five conditions of readiness, or perhaps more than five, with the time interval from landfall defining each condition of readiness to be varied as desired.

Corresponding to the conditions of readiness, preferably,

will be preferred activities at the decontamination site, to prepare for the possible onset of destructive winds. The following are examples:

Condition V - conduct normal daily site cleanup and maintain good housekeeping practices.

Condition IV - conduct normal daily site cleanup and maintain good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the end of each workday. Other objects that could become missile hazards should also be removed.

Condition III - Condition IV requirements should be maintained. In addition, personnel should begin securing the site and taking those actions necessary for Condition I that take more than 18 hours to complete. Any routine activities that interfere with securing operations should be ceased.

Condition II - routine activities should be curtailed or ceased entirely until securing operations are complete. Machinery, tools, equipment and materials should be secured or removed from the site. Any remaining missile hazards should be secured or removed from the site.

Condition I - complete all remaining securing actions, secure the site, and evacuate.

It is preferred that the progress of the potential destructive wind source be monitored regularly, in order to determine whether a particular condition is still applicable or whether a change in condition status is appropriate. The

frequency of such monitoring should increase as progress in the direction of Condition I continues. For example, in Conditions V, IV, and III, monitoring the progress and location of the potential destructive wind source may occur three times per day. In Condition II, such monitoring should occur about every three hours. In Condition I, such monitoring should be continuous.

Destructive winds are not the only weather hazard that may be of concern to a de-contamination site. For example, lightning also poses a potential hazard. When a lightning flash is observed in the immediate area or within a range of about 4 miles, outside activities should be suspended. (Lightning distance may be measured using the flash/bang technique, according to which lightning is one mile away for each five seconds that passes from the time of observing the lightning flash to hearing the associated thunder.) Indoor activities may be continued, except for the use of electrical equipment, telephones and computers. Outdoor activities can be resumed when the lightning moves beyond 4 miles from the site.

It should be recognized that the individual methods described herein, including remediation of goods (e.g., mail items), vehicles, facilities, and personal protective equipment could be utilized individually or as part of a comprehensive response to a biological attack. Moreover, while the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form

and details may be made therein without departing from the spirit and scope of the invention.

For example, additional packaging steps may be desired for mail items, or certain ones may be modified or eliminated, while still preserving the essential effectiveness of the irradiation treatment. Some departure from the contact times described herein may be permitted without unduly reducing the effectiveness of the bleach solution treatment. The concentration of the bleach solution may be altered slightly, to make it slightly more or slightly less concentrated, while maintaining decontamination effectiveness and compliance with applicable health and safety guidelines. It may be desired to wear additional personal protective equipment, beyond that described herein, which additional equipment would also need to be remediated. The contamination reduction zone could have more, or fewer, decontamination areas than are described herein. The types of weather conditions monitored; the number, duration, and qualifying factors for conditions of readiness; and the types of permitted/recommended activities for particular conditions of readiness can also be varied.